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16. Abstract (Limit: 200 words)

Implementing a volume performance standard for medical staffs requires a number of technical analyses, including a casemix measure based on inpatient services and payment or performance adjustors at the medical staff level. These technical analyses were provided in an earlier report, however, in measuring physician services (i.e., volume and intensity) per admission, the earlier report used deflated physician charges. This report uses the Medicare Fee Schedule (MFS) relative value units (RVUs) in the same claims data to measure physician service volume and intensity. Deflated charges may reflect the historical distortion in the pre-MFS system resulting from physician charging practices. Consequently, the impact of using RVUs instead of charges in the development of the casemix measure and multivariate analyses of RVUs per admission is examined and compared to prior findings on deflated charges. Database construction and the development of the casemix measure are also reviewed. This research is conducted under a HCFA cooperative agreement #18-C-90038/3-01

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Analysis of Hospital Medical Staff Volume Performance Standards: Technical Report

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I. INTRODUCTION

Implementing a volume performance standard for medical staffs requires a number of technical analyses. For example, a casemix measure based on inpatient physician services as well as payment or performance adjustors at the medical staff-level (e.g., teaching) must be developed. These technical analyses were provided in an earlier report (Miller and Welch 1991). However, in measuring physician services (i.e., volume and intensity) per admission, the earlier report used (deflated) physician charges. With the implementation of the Medicare Fee Schedule (MFS) in January 1992, Relative Value Units (RVUs) became a key element in the payment system and thus the underpinnings of a medical staff policy should also be based on RVUs. Equally important, RVUs represent a more direct measure of physician service volume and intensity. Deflated charges may reflect the historical distortion in the pre-MFS system resulting from physician charging practices. Consequently, it is important to revise the technical foundations of a medical staff policy using RVUs rather than deflated charges.[1]

Although a number of technical issues will be touched on in this report, two should be highlighted. The casemix measure is critical to a policy: a policy must credibly be able to control for differences between medical staffs in their mix of patients. Consequently, the impact of using RVUs instead of charges in developing the casemix measure is important. Similarly, adjustors at the medical staff-level could also be affected by the use of RVUs rather than charges.

The next section reviews the database construction. The third section reviews the development of our casemix measures. In this section we will analyze the impact of using RVUs rather than charges to measure casemix. The fourth and fifth sections present, respectively, a

[1]Undertaking this analysis using RVUs rather than changes is an important innovation. In reconstructing the database another innovation was also added. Using a national sample presents the potential problem of few admissions for a given hospital. Appendix A discusses significance tests to judge the reliability of the RVUs per admission calculated for a given hospital. Although the significance measure does not come into play in this paper, it will be important in future work.

univariate and multivariate analysis of RVUs per admission. These two sections review the impact on medical staff adjustors of using RVUs rather than charges.

II. DATA CONSTRUCTION

The construction of our database using 1987 claims data has been described in detail elsewhere (Miller and Welch 1991), and we followed the same process here, where we used 1989 data. Since we were interested in capturing physicians services related to the admission, we needed two 1989 files: Medicare Provider Analysis and Review Record (MedPAR) and Part B Medicare Annual Data (BMAD). Both are 5 percent beneficiary samples.

We performed the same basic data quality screening performed when the charge database was constructed. Screens that are important for conceptual reasons are reviewed here in more detail. Using the Health Insurance Skeleton Eligibility Write-Off (HISKEW) file, we excluded any beneficiaries who were only eligible for Part A because these beneficiaries cannot have Part B (e.g., physician) bills. MedPAR includes the admission bills for most beneficiaries in HMOs, but physician bills for these beneficiaries do not consistently appear in BMAD.[2] The inclusion of HMO beneficiaries in our analysis would inappropriately lower average RVUs per admission. Thus we eliminated any beneficiary who was enrolled in an HMO at any point during 1989.

We performed the basic screening on the MedPAR records that we had performed previously.[3] We screened the BMAD data to included only physician services as defined in the Omnibus Budget Reconciliation Act (OBRA) of 1989 and promulgated in the Federal Register (December 12, 1989, pp. 53818-53821). MedPAR and BMAD records from Rhode Island were dropped because data are incomplete for 1989 in the 5 percent BMAD. Certain hospitals (referred to as "cost election" hospitals) can elect to receive a lump sum for physician services

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[2] HMO membership includes beneficiaries in risk-contract HMOs, cost-contract HMOs, and Health Care Prepaid Plans (HCPPs).

[3] For example, MedPAR records were eliminated for duplication, invalid dates of service, zero charges, admission to non-PPS hospitals, and invalid DRGs (e.g., 470).

rather than their physicians being paid under the usual fee-for-service rules. Admissions (and associated physician bills) from cost election hospitals were removed because physician bills are not submitted to BMAD.[4]

Physician bills were linked with admission bills based on beneficiary ID and date of service. Services rendered on or between the date of admission and date of discharge were defined as services provided during the hospital stay. Also based on the beneficiary ID and date of service, we defined 28-day pre- and post-windows around the stay. The same series of rules used previously were used to deal with transfers. physician records imperfectly matching the stay, physician records imperfectly matching the window, and splitting the window periods between admissions that occurred close together. Briefly:

- BMAD records were matched first on the stay and only then on the window.
- If the BMAD period of service imperfectly matched a <u>single</u> stay, all BMAD RVUs were assigned to the stay.
- If a BMAD period of service overlapped <u>two</u> or more stays (a rare event), all RVUS were assigned to the second stay.
- If (after attempting to match on the stay) the BMAD period of service imperfectly matched a <u>single</u> window. all RVUs were assigned to the window.
- If a BMAD period of service overlapped <u>two</u> windows (a rare event), the RVUs were assigned to the second window.

Once physician records were linked with admission bills, the next step was to assign RVUs to each bill. The fundamental problem was that we wished to analyze physician services in terms of RVUs but as yet there are no data on services paid for under MFS. Hence, we assigned RVUs to pre-MFS bills, in particular, bills for 1989.

<u>General strategy for assigning RVUs</u>. For most bills the RVUs can be determined based on the HCPCS code and the modifier, which distinguishes between professional, technical, or

[4] The Rhode Island screen and the cost election hospital screens were actually undertaken after the linkage of physician bills to admissions because they involve the hospital provider ID.

global components. The MFS as published in the November 25, 1992 Federal Register was obtained in machine-readable form.[5]

The total RVUs--the sum of the work, practice expense, and malpractice RVUs--was first assigned to each bill. Because even "total RVUs" pertains to one unit of service and a bill may represent several units of service, the number of RVUs assigned to a given bill was the product of the "total RVUs" and the units of service.

Visits and consultations. The MFS changed the definitions of evaluation and management codes (i.e., visit and consultation codes). The Federal Register (pp. 59580-81) provides a crosswalk between the old and new codes. In many cases, the old code crosswalks to one new code (e.g., old 90000 becomes new 99201). When two old codes crosswalk to one new code, each old code was assigned the RVUs of the new code.

Complexity arises only when one old code crosswalks to several new codes (e.g., old 90200 becomes 99204, 70 percent of the time and becomes 99205, 30 percent of the time). In such cases, we assigned the new visit code the weighted average RVUs of its old equivalents (e.g., RVU of 90200 is .7 of the RVU of 99204 and .3 of the RVU of 99205).

Initial consultation codes now differentiate by place of service, whereas place of service had no impact on payment prior to the MFS. More precisely, an initial consultation in the hospital or nursing facility has a slightly different RVU than an initial consultation elsewhere. Because of our focus on inpatient physician services and in the interest of simplicity, we crosswalked the old codes to the new codes for in-hospital consultations.

Bills that cannot be directly assigned RVUs. There are a number of reasons why certain bills cannot be directly assigned RVUs: (1) the HCPCS code on the 1989 bill does not link to a HCPCS code explicitly in the MFS, because the code is carrier-specific or because it was deleted prior to 1991; (2) the HCPCS code does link but the MFS explicitly lacks RVUs for the code

[5] All references to the Federal Register hereafter refer to November 25, 1992 unless otherwise noted.

(status codes C, D, E, or X, see below); and (3), the HCPCS code is for an anesthesia service which is not technically part of the MFS. Whatever the source of the problem, our solution was to calculate "RVU equivalents." This involved deflating charges by a Medicare prevailing charge index (Pope et al. 1988) and dividing deflated charges by $31.001, the 1992 conversion factor. About 14 percent of the total physician charges in BMAD were on bills for which RVU equivalents had to be assigned.

Status codes. The MFS assigned each HCPCS code a status code to indicate whether the code is in the fee schedule and whether it is separately payable. Most expenditures are for HCPCS codes that have a status code of either A (active) or V (visits). Status codes of T and Z represent injections and EKGs. and under the MFS no payment is made for such services if they are delivered as part of a visit. Hence, we assigned bills with status codes T and Z zero RVUs. Status codes C, D, E, and X indicate codes without RVUs but which Medicare pays for (or paid for). As noted above, RVU equivalents were calculated for these codes.

The remaining status codes did not require special attention. Status codes B and P pertain to services that are always bundled into another service and hence, have zero RVU in the MFS. Status code N pertains to noncovered services, which have zero RVU in the MFS. Hence, status codes B, P, and N were assigned zero RVUs.

Anesthesia services. Anesthesia services involve several complexities: (1) they have base and time units. (2) they are technically not part of the MFS; and (3), their HCPCS coding was changed in 1989. An anesthesia fee in 1992 is the sum of the base and time units, multiplied by the anesthesia conversion factor of $13.94. Each anesthesia HCPCS code's base unit, which reflects the complexity of the procedure is analogous to an RVU, and is printed in Appendix A of the Medicare Carrier Manual. The time unit is the time actually taken by the anesthesiologist. Each time unit represents 15 minutes.

The base and time units for each bill were summed to obtain total units. Because RVUs are not defined for anesthesia services, we had to create RVU equivalents. This was done by

multiplying the total units by $13.94 (the anesthesia conversion factor) to obtain the 1992 fee. This fee was divided by $31.001 (the MFS conversion factor) to obtain RVU equivalents.[6]

Modifiers. Besides the professional-technical modifier, we modeled several modifiers: multiple surgery, bilateral surgery, assistance at surgery, and two surgeons. For instance, RVUs for bills for multiple surgery were multiplied by .75, because a second surgery is reimbursed at 75 percent of the RVUs. New modifiers are not on old bills and hence cannot be adjusted for.

Limitations. At least two aspects of the MFS were not addressed. The MFS standardized global fee periods, used to vary widely among carriers. It would be difficult to determine which services were billed separately but now would be included in a global fee, in part because carriers did not necessarily follow their stated rules. Nor can it be determined which services included in a global fee would now be billed separately. Unscrambling this omelette is not possible. Luckily, any impact of changes in global fee periods is presumably greater on outpatient physician services than inpatient physician services, the latter being our focus.

For specified codes, Medicare pays more when the service is delivered in an office than a hospital outpatient department. This site-of-service differential was not incorporated into our RVU assignment algorithms. Our analysis focused on inpatient physicians services. It is not necessary to recognize the site-of-service differential for the purpose of assigning RVUs during the inpatient stay. However, we also examined physician services provided during windows around the stay and for these services the site-of-service differential could have had an affect on the assigned RVU.

Summing to the Admission Level. At this point, each admission was linked to its associated physician bills provided during the stay (and 28-day windows around the stay). Each physician bill has the RVUs assigned for the service. The next step was to sum RVUs to the

[6] Anesthesia services delivered prior to March 1989 were coded using surgical codes. These anesthesia services were identified using HCFA's type of service indicator and certain modifiers, and RVU equivalents were created. Because HCFA decreased the anesthesia conversion factor by 7 percent in 1991 and another 29 percent in 1992, we divided anesthesia charges by 42.79 (31.001*1.07*1.29) in creating RVU equivalents.

admission level. For example, assume that an admission bill was linked to four physician bills. Summing to the admission level results in one record per admission with total RVUs per admission.[7] At this point the file contained 447,594 records, one for each admission.

This admission-level file was separately aggregated to two levels. The admission file was aggregated to the DRG-level (i.e., RVUs per admission by DRG) for the purpose of calculating national weights that serve as the basis of our casemix measure. In turn, our casemix measure allowed us to casemix-adjust RVUs per admission at the medical staff-level (i.e., hospital-level). The admission file was then aggregated to the medical staff-level for the purposes analyzing variations in RVUs per admission across medical staff types (i.e., urban/rural).

III. DEVELOPING THE CASEMIX MEASURE

The first step in developing a casemix measure was to compute physician service weights by DRG, which required the assignment of a DRG to each admission. DRGs were assigned on the basis of ICD-9 diagnosis code. HCFA's "grouper" program uses the ICD-9 codes on a given admission bill to make a DRG assignment. Both the ICD-9 codes and the grouper go through (usually minor) changes every year. Our data were for 1989 and we used the FY89 grouper to assign DRG.[8] With the assignment of DRG, we were able to calculate mean RVUs per admission for each DRG as well as RVUs per admission for all DRGs (i.e., all admissions). Recall that given the design of the database, we were able to calculate RVUs per admission by DRG for the stay only and the stay plus windows (referred to as the episode). This, in turn, allowed us to calculate DRG weights for these two variants.

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[7] Note that in addition to total RVUs per admission, the file contained RVUs per admission for 15 type-of-service categories. That is, total RVUs per admission were disaggregated into 15 type-of-service categories (e.g., major procedures, advanced imaging). An aggregation of the 23-category Holahan and Berenson type-of-service classification was used. Future work will explore RVUs per admission by type of service.

[8] We had hoped to use a later version of the DRG grouper--FY91, for example. However, 13 DRGs were added to the grouper in FY91 (e.g., 483 tracheostomy except for mouth, larynx, or pharynx disorder). In order to assign a FY91 DRG, both a crosswalk between FY89 and FY91 ICD-9 codes as well as the FY91 grouper were necessary. We found that documentation and software enabling one to systematically "track" changes in the DRG groupers and ICD-9 classifications were lacking.

Truncating for Outliers. As developed in our previous reports, a medical staff policy might include a PPS-like outlier policy.[9] We considered a number of outlier definitions (e.g., 2 times the DRG mean, the lesser of 2 times the DRG mean and $10,000). An outlier threshold of 2.5 times the DRG mean was selected.[10] RVUs per admission were "truncated" at the outlier threshold. That is, if the RVUs for a given admission exceeded the outlier threshold for its DRG, the RVUs were truncated at the outlier threshold. Truncating at the outlier threshold allowed us to construct relative weights with and without outlier RVUs, in addition to weights for the stay and episode.

Low-Volume DRGs. The next step was to calculate relative weights, which was conceptually a straight-forward process--RVUs per admission for each DRG are divided by RVUs per admission for all DRGs (i.e., the national mean) to obtain a relative weight. Since the national mean was admission weighted, the weights were normalized to 1.0.

However, for DRGs with small numbers of admissions (referred to as "low-volume" DRGs), the estimation of a reliable mean is questionable. For example, the September 4, 1990 Federal Register PPS final rule indicates that nationally 33 DRGs had fewer than 50 admissions. These DRGs are usually not important to the Medicare population (many pertain to pregnancy or children). Since relative weights were used to calculate hospital-level casemix values, unreliable mean RVUs per admission could result in a less defensible measure of casemix.[11] The problem of low-volume DRGs was compounded by working with 5-percent sample. A DRG with 2,500 admissions nationally would have about 125 admissions in the 5-percent sample. (This figure could be even lower as a result of attrition resulting from data screening.) Using the 5-percent sample after data screening, we found that 141 DRGs (30 percent) had fewer than 100

[9] The motivation would be to protect medical staffs from the impact of a few high-cost cases and to protect access for potentially costly Medicare patients.

[10] Using 1987 deflated charges this outlier definition resulted in an outlier pool of about 4 percent.

[11] Note that the precision of the casemix measure can be calculated at the hospital-level or the DRG-level. Because the medical staff policy would apply to the hospital-level, precision at that level was the greatest concern. At the hospital-level the low-volume DRG problem should not be great--at this level overestimated DRGs should cancel out underestimated DRGs. Nonetheless, our correction for low-volume DRGs was performed by at the DRG-level.

admissions. At the same time, there was reason to believe that the low-volume DRG problem was not substantial, because these 141 DRGs with less than 100 admissions only accounted for 1 percent of all admissions.

To correct the low-volume DRG problem, low-volume DRGs were identified and regression was used to impute RVUs per admission. To identify low-volume DRGs, we drew on Pettengill and Vertrees' (1982) work in developing a DRG-based casemix measure for PPS, which used the standard error of the DRG to estimate the precision of the mean.[12] The Pettengill and Vertrees criteria determined the number of admissions needed to estimate the mean (i.e., RVUs per admission for a given DRG) within a specified range of precision.[13] We selected the same criteria used when developing DRG weights for PPS--that the estimated mean is within 10 percent of the true mean 90 percent of the time, which can be expressed as:

$$(16.5 * \text{coefficient of variation})^2$$

Note that this approach allowed the criteria to vary by DRG. Thus a DRG with a coefficient of variation (CV) of 1.0 needed 272 admissions to meet the precision criteria whereas a DRG with a CV of .5 needed 68 admissions to qualify.[14]

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[12] Pettengill and Vertrees' precision criteria required a DRG's mean to be within 10 percent of the true mean 90 percent of the time in order to be included in the development of the original DRG weights. The September 1, 1983 Federal Register PPS final rule suggests that 109 DRGs were determined to be low-volume. In the final analysis, data from the 20-percent MedPAR were used to develop weights for the high-volume DRGs and data from two states were used to develop weights for low-volume DRGs.

[13] DRGs with less than 10 admissions in the 5 percent sample were defined as low volume. This ten admission minimum is essentially arbitrary, although we note that since 1986, the annual recalibration of DRGs is performed on those DRGs with 10 admissions or more. DRGs with less than 10 admissions remain unchanged.

[14] The precision criteria was applied to RVUs per admission during the stay, untruncated for outliers. We used the stay (as opposed to the episode) as the basis of our casemix because the stay was more readily understood and less open to disagreement regarding its definition. We used untruncated RVUs because presumably DRGs qualifying on the basis of untruncated RVUs would also qualify on the basis of truncated RVUs.

Applying the precision criteria), 264 DRGs (55 percent) had sufficient admissions. These "high-volume" DRGs accounted for 90 percent of admissions. The remaining 10 percent of admissions were found in 213 low-volume DRGs.[15]

To estimate average RVUs (and, in turn, relative weights) for low-volume DRGs, we assumed that the PPS weight was a reasonable predictor of the relative physician weight. Mitchell et al. (1984) found that PPS and physician DRG weights are highly correlated ($r=.84$). Thus, for the 264 high-volume DRGs we regressed RVUs per admission on the PPS weight, a binary variable indicating whether the DRG was medical or surgical (coded 1 if surgical), and an interaction term between the medical/surgical binary variable, and the PPS weight. Inclusion of the medical/surgical indicator and the interaction term increased the precision of the equation by allowing the intercept and slope estimates to vary when the DRG was surgical. The regression equation takes the form:

$$\text{RVUs per admission}=b_0+b_1\text{PPSweight}+b_2\text{SurgDRG}+b_2(\text{SurgDRG*PPSweight})$$

Four variants of the dependent variable were used: the stay only versus the episode and untruncated for outliers versus truncated. The regression results (unnormalized and normalized) are presented in Table III-1. All regressors are significant and explain three-quarters of the variation in RVUs per admission across DRGs. The results are similar regardless of the explanatory variable used and are similar to those obtained when this analysis was performed on charges rather then RVUs.

The normalized regression results provided a convenient form for interpreting the relationship between the PPS weight and the physician weight. When the dependent variable pertained to the stay only and was truncated for outliers, a medical DRG with a PPS weight of 1.0 predicted an RVU weight of .65 (.29+.36). A surgical DRG with a PPS weight of 1.0 predicted an RVU weight of 1.25 (.29+.36+.27+.33).

[15] When relative weights were created for DRGs using deflated charges (Miller and Welch 1991), 176 DRGs were identified as low-volume. The addition of the 10 admission minimum accounts for the difference between the previous (charge-based) analysis and the present (RVU-based) analysis.

Two results are consistent with those obtained using physician charges rather then RVUs. The normalized PPS weight coefficients are below 1.0, suggesting that physician service weights are more compressed than PPS weights.[16] Or in other words, for both medical and surgical DRGs, physician services weights cluster closer to the mean than do PPS weights. Also the surgical DRG coefficients (intercept and slope) are positive, indicating that surgical DRGs have higher volume and intensity of physician services than medical DRGs even after controlling for the PPS weight. This indicates that relative to medical DRGs, physician costs are a greater proportion of the entire cost (hospital and physician) of a hospitalization for surgical DRGs. One result is different than that obtained using charges but this difference was anticipated. The surgical differentials fall when RVUs were used rather than charges because RVUs grant greater weight to the physician effort involved in nonsurgical services. Using charges (for stay only, truncated) we obtained surgical differentials of .41 (intercept) and .36 (slope); using RVUs we obtained surgical differentials of .27 and .33, respectively.

In summary, RVUs per admission were computed for the 264 high-volume DRGs and the unnormalized regression coefficients in Table III-1 were used to predict average RVUs for the 213 low-volume DRGs. This yielded stable estimates of mean RVUs for each of the 477 DRGs. Table III-2 presents the RVUs per admission for each of the four variants of the dependent variable for all DRGs as well as for medical and surgical DRGs separately. There was an average of 36 RVUs per admission for the stay, truncated for outliers. Using the 1992 MFS conversion factor of $31.001, this translates into an average Medicare physician payment of $1,116 per admission. When windows are included there are approximately 44 RVUs per admission ($1,364 per admission).

Again focusing on RVUs for the stay, truncated, surgical DRGs have just over three times the number of RVUs per admission (70) as medical DRGs (22). When charges were analyzed, the average charge for surgical DRGs was nearly four times that for medical DRGs. This reduction in the difference between medical and surgical DRGs was expected given that RVUs

[16] For medical DRGs this is simply the PPS weight coefficient. For surgical DRGs it is the weight coefficient plus the interaction term.

grant greater weight to nonsurgical services. When windows were included, surgical DRGs (80 RVUs per admission) were 2.8 times greater than medical DRGs (29 RVUs per admission). The surgical/medical DRG difference decreased with the inclusion of windows, because as demonstrated in our previous research, medical DRGs had a greater proportion of RVUs in the window.

Comparison of Weights We derived relative weights for each DRG by dividing RVUs per admission for each DRG by RVUs per admission for all DRGs. As noted, we developed four sets of weights: stay versus stay plus windows and truncated for outliers versus untruncated. Our previous research established that the relative weights were virtually the same regardless of whether charges were truncated or not and regardless of whether windows were included or not. We selected the stay, truncated for outliers as the basis of our casemix measure, because the stay is more readily understood and a policy would in all likelihood include a outlier policy. In much of the analysis to follow, the stay truncated for outliers was our reference point.

Similar to charges, when RVUs were used to develop the weights, there were only minor differences in the four weight variants. Table III-3 reports the correlation between the four sets of RVU-based weights--all are correlated at .998 or higher. However, the correlation coefficient is only a measure of the covariance between the relative weights indicating, for example, that a given DRG has a high weight regardless of whether the stay or the episode is used. Regressing one set of weights on another provides additional information regarding the proportionality of weights, that is, whether the actual weight for the DRG was nearly equal across the sets of weights. A regression coefficient of 1.0 indicates perfect proportionality. Thus we regressed the stay-untruncated weights on the stay-truncated weights to test for the impact of truncating. And we regressed episode weights on stay-only weights (both sets truncated for outliers) to test for the impact of using an episode rather than the stay.

Table III-4 reports the results of these two regressions. (Note that both of the regression coefficients are significantly different than 1.0 at the 99 percent level of confidence.) The regression results indicated that truncation has little impact on the weights--the regression

coefficient is .98. Defining an episode rather than the stay as the basis of the relative weights appeared to have some impact on the weights. The regression coefficient of .86 indicated that although nearly proportional, weights based on the episode were somewhat more compressed than those based on the stay only.

To investigate the impact on the relative weights of using RVUs rather than charges, we separately regressed the 1989 RVU-based weights (stay, truncated) on the 1987 and 1989 charge-based weights.[17] Table III-5 reports the results of these two regressions and shows that RVU-based weights are nearly proportional to charge-based weights.[18] Again, both regression coefficients were significantly different than 1.0 at the 99 percent confidence level. Not surprisingly, the 1989 RVU-based weights were more proportional to the 1989 charge-based weights (b=.86) than to the 1987 charge-based weights (b=.81). These results suggested that RVU-based weights are more compressed than charge-based weights. This is not surprising given that RVUs are a more direct measure of volume and intensity than deflated charges. Presumably even after deflating, charges may still reflect some of the historical fee distortions present in Medicare's fee-for-service reimbursement system.

Appendix B reports the PPS weight, the relative physician weight using 1987 (deflated) charges, and the four new sets of relative physician weights using 1989 RVUs for each DRG. Having created relative weights for each DRG, the next step was to construct an analysis file aggregated to the hospital level. The national weights allowed us to compute a casemix value for each hospital. Such a file allowed us to analyze variations in casemix-adjusted RVUs per admission by medical staff type (e.g., urban/rural), which we now turn.

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[17] Recall that charges were deflated for geographic variations in fees using a Medicare prevailing charge index before deriving relative weights (Pope et al. 1988).

[18] Also note that Table III-3 shows very high correlations between the charge-based weights and the RVU-based weights. The 1987 charge-based weights are correlated with the four RVU-based weights at .956 or greater. The 1989 charge-based weights are correlated with the four RVU-based weights at .978 or greater.

IV. UNIVARIATE ANALYSIS

The next step was to perform univariate analysis of RVUs per admission by medical staff type. The first objective was to better understand variations in volume and intensity of inpatient physician services across different types of medical staffs. Our previous analysis using deflated charges as a measure of volume and intensity led us to a number of conclusions, for example, physicians services per admission are higher in urban hospitals. Although deflated charges provided a good proxy for volume and intensity, there were a number of reasons to reexamine these patterns using RVUs. RVUs are a more direct measure of volume and intensity, RVUs provide more appropriate weight to evaluation and management services, and RVUs are now the basis of Medicare physician reimbursement policy. The second objective of this analysis was to examine which types of staff might be advantaged or disadvantaged under a medical staff policy.[19]

Throughout this paper we have used a file that is the product of merging the 1989 5 percent MedPAR and BMAD files to produce RVUs per admission. The hospital-level file used for this univariate analysis (and the multivariate analysis to follow) is the product of merging three hospital characteristics files with our RVU file. We merged the HCFA Provider Specific File (PSF) and Hospital Cost Reporting Information System (HCRIS) files (based on hospital provider ID) to obtain such policy relevant variables as urban/rural location, the intern-and-resident to bed ratio (to determine teaching status), and the disproportionate share percentage (to determine disproportionate share status). We merged the 1990 American Hospital Association (AHA) annual survey data to obtain such characteristics as size and composition of the medical staff, whether the hospital provides certain services (such as a cardiac catheterization lab), and the region where the hospital is located. The product of this merge was a file containing 5,185 hospitals and 433,721 admissions.[20]

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[19] Recall that if a payment policy of some form were pursued, medical staffs with higher than average casemix-adjusted RVUs per admission would be disadvantaged. However, if a policy tied to the growth in RVUs per admission were pursued, the impact is less clear.

[20] Three percent of the admissions were lost due to an inability to match on hospital provider ID across the various files.

Previously when developing a hospital-level file using charges, we found a number of staffs to have extremely low charges per admission (e.g., less 25 percent of the national mean). One of the explanations for these very low charge hospitals is the presence of HMO beneficiaries for whom physician bills are not submitted through BMAD. As noted above, we eliminated admissions that would bias a medical staff's RVUs per admission downward due to incomplete data reporting by excluding HMO enrollees, admissions in cost election hospitals, and admissions in Rhode Island.[21] Nonetheless we found a number of medical staffs with extremely low RVUs per admission. (There were very few medical staffs with extremely high RVUs.)

Extremely low-RVU medical staffs followed several patterns. For example, a sizeable proportion are Public Health Service hospitals serving American Indian reservations and others could be cost-election hospitals (apparently, no definitive list of such hospitals is centrally maintained). We decided to trim (i.e., eliminate) extremely low-RVU medical staffs from the data. Our objective was to trim the bottom 2 to 2.5 percent of the distribution. Setting a threshold of approximately 30 percent of the national mean trims 109 (2.1 percent) medical staffs from the data.[22] These staffs have very few admissions--only 949 admissions (approximately two tenths of a percent) were eliminated. Thus, the resulting analysis file contained 5,076 hospitals and 432,772 admissions.

Computing GME Costs. Before moving to the analysis, recall that our previous research found that major teaching hospitals had lower physician charges per admission than either nonteaching and minor teaching hospitals.[23] Given the pattern of inpatient facility costs, it was expected that the medical staffs of teaching hospitals would have higher than average charges per admission. Physicians submit charges through Part B, but interns and residents, who provide physicians services in teaching hospitals, do not. The salaries and benefits of interns and

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[21] In addition to screening for HMO beneficiaries, we also eliminated 31 HMO hospitals (usually Kaiser); these hospitals tend to have very low RVUs per admission. Their few admissions of fee-for-service beneficiaries may be emergency admissions.

[22] The stay, truncated for outliers, was used for the purposes of trimming, which was based on the geometric mean (i.e., a log-normal distribution).

[23] Major teaching hospitals are those with intern-and-resident to bed ratios greater than .25.

residents--referred to as graduate medical education (GME) costs--are reimbursed to the hospital as a pass-through payment under Part A. Plausibly interns and residents substitute for physicians in teaching hospitals and the degree of substitution may depend on the level of teaching activity (greater substitution in major teaching hospitals). Since interns and residents provide physician services, it was important to have the capability to estimate their costs.[24]

In calculating GME costs per admission, we followed the same methodology as in our previous work except that we obtained more reliable (i.e., audited) GME data. HCFA Bureau of Program Operations (BPO) collected and audited GME data for the base year, 1985.[25] The first step was to estimate a national average cost per full-time equivalent (FTE) resident and then convert costs to RVU equivalents.

Using audited data only, there were (approximately) $2.6 billion in GME costs and 57,926 interns and residents in 1985--a per resident amount of $44,746. Section 1886(h) requires the base year per resident amount to be updated using the CPI for all urban consumers. Since we were interested in dividing the final per resident amount by the 1992 conversion factor (CF) in order to obtain RVU-equivalents for GME costs, we inflated the base year per resident amount forward to 1992 obtaining $63,712. Dividing by the 1992 CF of $31.001, yielded mean RVUs per resident of 2,055.

For each hospital the per resident amount was casemix-adjusted and multiplied by the number of interns and residents per admission (i.e., <u>all</u> admissions in the hospital) to obtain GME RVUs per admission:

(Interns and Residents/Admissions)*(2055/Casemix)

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[24] From a policy perspective, identifying and quantifying services provided by interns and residents provides policymakers the options of including GME costs under the policy or including GME costs only for the purpose of measuring medical staff performance. From a research perspective, when examining the determinants of inpatient physician volume and intensity, <u>all</u> physician services, including those provided by interns and residents, should be included.

[25] Section 1886(h) of the Social Security Act requires the establishment of a per resident amount for 1985, the base year. This base year per resident amount is updated for payment purposes in subsequent years using the CPI for all urban consumers.

GME amounts were zero for nonteaching hospitals. In the analysis to follow, GME RVUs per admission were added to RVUs per admission to obtain "total" physician RVUs per admission.[26]

Casemix and RVUs per Admission. Table IV-1 reports mean RVUs and casemix by type of medical staff; all figures were admission weighted.[27] Three variants of RVUs per admission for the stay, truncated for outliers, are reported: unadjusted for casemix, casemix-adjusted, and casemix-adjusted including GME. All RVU figures were normalized to the national mean. We found that casemix ranged from a high of 1.26 for hospitals with more than 500 beds, to a low of .69 for hospitals with less than 50 beds. Casemix was higher for nonprofit, large, urban, teaching, disproportionate share, and Western hospitals. These results are not surprising and are consistent with our findings using charge-based weights.

Nationally there are 37.21 (CV=.33) RVUs per admission unadjusted for casemix. Not surprisingly, the same medical staff types that have higher casemix also have higher than average unadjusted RVUs. Again, these findings are consistent with our charge-based analysis.

The third column of the table reports casemix-adjusted RVUs per admission. Nationally casemix-adjusted RVUs per admission are 36.08 (CV=.20). Given that differences in casemix are likely to account for much of the differences in RVUs per admission, it is not surprising that adjusting for casemix substantially reduced variation around the national mean. In fact, after casemix-adjusting, no medical staff type was more than seven percent above the national mean (as opposed to the unadjusted figures where the one staff type was 28 percent above the mean).

The effect of casemix-adjusting was to move medical staff types toward the national mean, although they generally maintained their respective positions. Relative to unadjusted

[26] Note that GME costs are also computed unadjusted for casemix for inclusion in the regression analysis in the next section.

[27] Using a national 5 percent sample may result in specific staffs having small samples, but there is no such concern when types of staffs are examined. The smallest number of admissions for a medical staff type is 19,015 (hospitals with less than 50 beds).

RVUs, adjusting for casemix increased RVUs per admission for the medical staffs of small, rural, nonteaching, and nondisproportionate share hospitals. Casemix adjustment decreased RVUs per admission in large, urban, minor teaching, and disproportionate share status hospitals. There was one important exception to this conclusion. Staffs in major teaching hospitals had unadjusted RVUs per admission 16 percent above the mean. However, because casemix in major teaching hospitals was 25 percent above the mean, casemix-adjusted RVUs per admission were 5 percent below the mean in these hospitals.

As noted above, interns and residents may substitute for physicians in teaching hospitals, particularly in major teaching hospitals. Because of this substitution and because GME costs were accounted for as a hospital cost (under Part A), our charge-based research found that major teaching hospitals had lower volume and intensity per admission than either nonteaching or minor teaching hospitals. When normalized RVUs were used instead of charges, this pattern remained: nonteaching (.97); minor teaching (1.06) and major teaching (.95). To explore this issue, column four of the table reports casemix-adjusted RVUs per admission including GME RVUs. When GME RVUs were added, the expected relationship between teaching activity and RVUs per admission was found. Nonteaching hospitals were 10 percent below the mean, minor teaching hospitals 8 percent above the mean, and major teaching hospitals 29 percent above the mean. Not surprisingly, where there was overlap with other medical staff types, the addition of GME also had an impact. Staffs in very large (500 beds or more) hospitals increased from 5 to 17 percent above the mean, staffs in large urban area hospitals increased from 7 to 12 percent above the mean, and staffs in disproportionate share hospitals increased from 1 percent to 7 percent above the mean.

When GME was included, we noted some significant differences between the charge-based results and the RVU-based results. Very large hospitals (500 beds or more) were 25 percent above the charge-based mean, but 17 percent above the RVU-based mean. Western hospitals were 4 percent below the mean when charges were used, but were at the mean when RVUs were used.

V. MULTIVARIATE ANALYSIS

This chapter extends the exploration of variations in inpatient physician services to a multivariate context. Univariate analyses do not control for many factors simultaneously (e.g., a teaching hospital that also provides care to disproportionate numbers of the poor). Multivariate analyses allows us to examine variations in physician services by medical staff type while holding other influences constant. Consequently this analysis will point to the types of adjustments that might be considered were a medical staff policy undertaken.

Two regression models were used--a policy model and a general model. The policy model's specification was strict, including only those variables that might be the basis of PPS-like adjustments for the purpose defining medical staff payments or performance. The policy model specification drew on the cost function literature generally and the PPS literature specifically (Pettengill and Vertrees 1982; Sheingold 1990), and was used to explore certain policy relevant issues (i.e., teaching and disproportionate share adjustments and the potential need to recognize regional variation).

The general model's specification was broader, and included variables that might provide a more complete understanding of variations in inpatient physicians services. Its specification drew on the expenditure model literature (Holahan, Dor, and Zuckerman 1991). For example, this model included the size and composition of the medical staff. We also explored performance of our casemix measure using this model.

Policy Model. The unit of analysis was the medical staff (i.e., hospital) and the dependent variable was casemix-adjusted RVUs per admission for the stay, truncated for outliers. By using casemix-adjusted RVUs as the dependent variable, this model assumed (as would be the case under an implemented policy) that casemix was equal to 1.0. Consistent with the PPS literature, a multiplicative relation was assumed and thus a log-linear model was used. That is, with the exception of binary variables, all variables were measured in the natural log. All regressions were admission weighted.

The policy model included only those variables typically considered for reimbursement purposes: the intern-and-resident-to-bed ratio (to measure teaching activity), the disproportionate share percentage (to measure disproportionate share status), binary variables for hospitals located in large urban areas (MSAs greater than 1 million) and other urban areas, and binary variables for two special rural hospital designations--rural referral centers and sole community hospitals.[28] Although not explicitly used for reimbursement purposes, bed size is typically included in models of this kind for two reasons. In a cost function framework, bed size served as a proxy for scope of services and economies of scale. In a policy context, its exclusion would bias the estimated effects of the remaining variables. Table V-1 reports the means for all independent variables used in this model and in the policy model below.

Table V-2 reports three variants of the policy model. Model 1 was the basic model and included only the variables described above. Model 2 included eight additional binary variables measuring regional variations; the nine census divisions were used as regional proxies and New England was the excluded region. This model estimated the differentials in RVUs by region. If these differentials are deemed important, policymakers may want to make regional adjustments for the purpose of evaluating medical staff performance. Region in this instance served as a proxy for differences in practice styles as well as the differences in the supply and composition of health care services (e.g., the number and specialty mix of physicians). Model 3 was the same as the Model 2 except that the dependent variable included GME costs. This model served to point out the specific impact of teaching activity when <u>all</u> physician services were included and to provide estimates of adjustments were a policy to include GME costs.

The policy model explained 40 percent of the variation in inpatient physician services, and virtually all coefficients were strongly significant. The model indicated that mean RVUs per admission decreased by about 5.2 percent for every 10 percent increase in teaching activity, that

[28] Note that unlike many PPS cost function analyses, there is no measure of input costs (e.g., HCFA area wage index). This is because the independent variable (RVUs per admission) is a direct measure of volume and intensity of service. Consistent with the PPS literature, teaching activity is measured as the log of 1+IRB Ratio and disproportionate share status is measured as the log of 1+DSH Percentage, where IRB Ratio is the intern-and-resident to bed ratio and DSH percentage is the disproportionate share hospital percentage. Rural hospitals are the excluded category for urban/rural location variables.

RVUs were about 23 and 18 percent higher in large and other urban areas, respectively, and that RVUs were about 12 percent higher in rural referral centers. These results were virtually identical to our charge-based results.

Two results were different than our charge-based results. Using charges, we found sole community hospitals to have charges 6 percent above those in other rural hospitals. Using RVUs, the sole community hospital coefficient was insignificant. A dramatic difference was found in the disproportionate share result: the coefficient in this RVU-based regression was negative (-.21) and significant, where as the coefficient was positive (.24) and significant when 1987 charges were used. Differences between the charge-based and RVU-based regressions can conceptually spring from two sources--the use of RVUs rather than charges and/or the use of 1989 data rather than 1987 data. With respect to the sole community hospital results, one explanation may be that the designation of hospitals changed between 1987 and 1989. This does not appear to be the case, as in both years approximately 3 percent of hospitals were classified as sole community.

The disproportionate share result is more disturbing because a significantly negative coefficient replaces a significantly positive one. Also, the policy importance of the disproportionate share designation is greater (disproportionate share payments to hospitals under Part A are expected to be $2.2 billion in FY92). Changes in the disproportionate share percentage occurred between 1987 and 1989--OBRA87 increased the adjustment for certain urban hospitals. In fact, the mean disproportionate share percentage in our data increased from .02 to .04 between 1987 and 1989 (while the variance remained the same). We regressed <u>1989 charges</u> per admission on <u>1987 hospital characteristics</u> and found a negative disproportionate share coefficient. Hence, neither the changes in the disproportionate share percentage nor the switch from RVUs to charges fully explains the change in the disproportionate share coefficient.

We also pursued two other possibilities: that a few extreme cases were driving the results or that the disproportionate share variable was nonlinear. To explore these possibilities, we

plotted the residuals of the regression equation against the log of the disproportionate share percentage. Neither of these explanations appeared to be true.

Given the high degree of overlap between teaching and disproportionate share hospitals,[29] one additional explanation for the negative coefficient may be the substitution of interns and residents for physicians in the provision of services in disproportionate share hospitals. Two additional analyses provided support for this conclusion. First, using the basic policy model specification (Model 1), we estimated an equation that included the log of the intern and resident-to-bed ratio, the log of the disproportionate share percentage, and an interaction term between the two. In this instance, teaching activity (-.36) and the interaction term (-1.68) were both negative and strongly significant. The disproportionate share variable (.01) was insignificant. These results suggest two points: a) staffs that are both teaching and disproportionate share have significantly lower RVUs per admission; and b) once the overlap between these two types of staffs is accounted for, the disproportionate share designation is irrelevant. Second, Model 3 in Table V-2 reports the policy model with GME RVUs included in the dependent variable (this model is discussed in more detail below). Note that when GME RVUs were added to total RVUs, the disproportionate share coefficient is small (-.05) and statistically insignificant.

Regional Effects Model 2 of Table V-2 includes the regional variables. Supply of services, demand for services, and practice styles may vary across regions. Consequently, policymakers may want to recognize some or all of these regional differences in paying staffs or in evaluating the performance of staffs. This could be accomplished by using the regional coefficients as adjustors. Alternatively, like PPS, a blend of regional and national rates could be used to determine performance during a transition to a national performance standard.

Including the regional variables increased the explained variance, but not dramatically (from .40 to .42). The regional regression coefficients indicated some degree of regional

[29] Seventy-seven percent of major teaching hospitals receive disproportionate share payments and teaching hospitals as a group account for 65 percent of such payments (Sheingold 1990).

variation. Relative to medical staffs in New England, staffs in the Mid-Atlantic, West South Central, and Mountain regions have higher RVUs per admission. The West North Central region has lower RVUs per admission. These results suggest that region might be considered in determining medical staff performance, at least during a transition period.

Including GME RVUs. The final variant of the policy model included GME RVUs in the dependent variable (Model 3, Table V-2). (The model including the regional variables is estimated.) The purpose of this model was to test our hypothesis regarding the teaching activity result. Previous research suggested that teaching activity should result in the provision of greater amounts of physician services. Our teaching activity coefficient was negative and significant (-.52), and we have argued that this results from the substitution of interns and residents for physicians.

When GME RVUs were included, the teaching activity coefficient was strongly significant and positive (.46). The direction and magnitude of the coefficient was as expected given our prior expectations regarding teaching activity. (If estimated for inpatient facility costs, the teaching activity coefficient is approximately .50.) As noted above, this model produced another very important result--the disproportionate share coefficient became statistically insignificant. This suggests that at least part of the explanation for the negative disproportionate share coefficient obtained above is attributable to the substitution effect.

A few final points are noteworthy. When the dependent variable included GME RVUs, the policy model explained a greater degree of variation (r^2=.56) than when it was estimated for physician services only (r^2=.42). One additional regional variable became statistically significant in the GME model. Pacific region staffs appeared to have lower RVUs per admission than the New England region, when GME RVUs were included. Beyond the changes in the coefficients for the teaching, disproportionate share, and Pacific region variables, the remaining coefficients were unchanged.

General Model. Continuing with our analysis of medical staff variations in the volume and intensity of physician services, we specified a general model. This model had two purposes. First, the general specification was used to explore the underlying determinants of RVUs per admission. Consequently, this model included variables beyond those typically considered for reimbursement purposes, drawing on the expenditure model literature (Holahan, Dor, and Zuckerman 1991) as opposed to the cost-function/PPS literature (Pettengill and Vertrees 1982, Sheingold 1990). Second, we wished to evaluate the performance of our newly constructed RVU-based casemix measure.

As with the policy model, the unit of analysis was the medical staff, a log-linear model was specified, and the regressions were admission weighted. The dependent variable was the log the mean RVUs per admission for the inpatient stay, truncated for outliers but unadjusted for casemix. Using unadjusted RVUs as the dependent variables allowed us to include the casemix measure as a regressor. Pettengill and Vertrees (1982) argued that a good measure of casemix will be approximately proportional to costs at the hospital level, implying an elasticity close to 1.0 in a log-linear regression equation.

There are three broad classes of independent variables. (Recall that Table V-1 reports means, standard deviations, and data sources for each of the variables used in the regression.) The first class is comprised of hospital characteristics and the inclusion of these variables is driven by the cost function literature and the PPS literature.[30] In addition to all of the hospital type variables included in the policy model, this class of variables includes casemix and the control of the hospital. Casemix measures differences in the mix of admissions across hospitals and its construction was discussed in detail above. Hospital control, a proxy for organizational efficiency and practice style, is measured using dichotomous variables for federal government, state government, and private proprietary hospitals (private nonprofit hospitals are the excluded group).

[30] Again, because the dependent variable is a direct measure of volume and intensity, an independent variable measuring input costs is unnecessary.

The second class of variables pertains to medical staff characteristics, two such variables are included. The first is the ratio of the medical staff to the number of beds (logged).[31] Mitchell et al. (1987) suggest that physician costs increase unnecessarily with the involvement of more physicians. The medical staff ratio is a proxy for the number of physicians involved in the admission and its expected sign is positive. RVUs per admission may also be affected by the composition of the staff. To measure staff composition, four categories were used: 1) generalists--general/family practitioner and internists, 2) surgeons, 3) medical specialists, and 4) radiologists/anesthesiologists/pathologists (RAPs).[32] The percentage of the staff in each of these categories was defined as a variable and the generalist category is the excluded group. It is expected that RVUs per admission will be higher with more specialized staffs.

The third class of variables pertains to variations in characteristics such as the supply of health resources, demand for services, and community practice styles. These factors were not directly measured; rather, the eight regional binary variables were included to control for differences in these factors across the country.

Table V-3 reports the results of three alternative specifications of the general model. Model 1 was the basic specification including the three classes of variables discussed above and explained 83 percent of the variation in RVUs per admission among medical staffs. The variables that were common to both the policy and the general model behaved the same in both models and (with the exception of disproportionate share status) will not be discussed further. Although we did not have explicit expectations regarding the hospital control variables, we found that RVUs are higher in proprietary hospitals and lower in state government hospitals.

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[31] Medical staff data (total and the specialty breakouts) are obtained from the 1990 AHA annual survey. Medical staff refers to practitioners with active and associate privileges in the hospital.

[32] Surgical specialty includes ophthalmology, orthopedic, thoracic, plastic, and other surgical specialties (e.g., neurological, colon/rectal, urology, etc.). Medical specialty includes medical specialties (e.g., pulmonary diseases, nephrology, allergy, etc.), pediatrics, obstetrics/gynecology, emergency medicine, dermatology, and psychology. RAPs includes radiology, anesthesiology, pathology, and nuclear medicine. We recognize that other categorizations are conceptually defensible, but regression analyses tend to lack the statistical power necessary to distinguish more categories.

Three of the four medical staff variables were significant. As the ratio of the medical staff to beds increased, RVUs per admission increased, suggesting that the involvement of more physicians in the provision of care does increase volume and intensity. The effect was relatively small however. The coefficient (*b*=.04) suggested that a 10 percent increase in the staffing bed ratio would increase RVUs per admission by 0.4 percent, or from the mean of 37 RVUs per admission to 37.15 RVUs, an addition of about $5 assuming the 1992 conversion factor ($31).

RVUs per admission also increased with the relative proportions of surgeons and medical specialists (the RAPs coefficient was positive, but significant only at the 90 percent level of confidence). In our sample, the average staff was 26 percent surgeons, 36 percent medical specialists, and 11 percent RAPs (the remainder, 27 percent, were generalists). Assuming the mean for each of the three staff composition variables, mean RVUs per admission were about 37. If the percentage of surgeons were to increase 10 percentage points (all other variables remaining constant), mean RVUs would increase by 2.7 percent, from about 37 to 38 RVUs per admission. Or, assuming the 1992 conversion factor, about $31 would be added to the admission if the relative proportion of surgeons increased by 10 percentage points.

The results obtained for the hospital control variables and the medical staff variables were consistent with those obtained when charges per admission were used. With two exceptions, the magnitudes of the hospital control and medical staff coefficients were similar. The medical specialist coefficient was higher (*b*=.17) for RVUs than for charges (*b*=.11), whereas the RAP coefficient was considerably lower (*b*=.07) for RVUs than for charges (*b*=.22).

Standardized coefficients (beta) provided a convenient measure of the relative importance of the regressors in predicting the dependent variable given their variances as well as their coefficients.[33] Casemix (beta=.67) was overwhelmingly the most important determinant of

[33] The beta coefficient is estimated from a regression where the variables have been standardized. It can be calculated from an unstandardized regression by multiplying the regression coefficient by the standard deviation of the independent variable and dividing by the standard deviation of the dependent variable. The casemix coefficient from the general model is 1.047, the standard deviation of (logged) casemix is .237, and the standard deviation of (logged) RVUs per admission is .370. Thus ((1.047*.237)/.370) = .67, the casemix beta coefficient noted above. Beta coefficients are interpreted as the number of standard deviation changes in the dependent variable resulting from

RVUs per admission. Bed size (beta=.17), teaching activity (stb=-0.16), and urban location (large urban beta=.19; other urban beta=.13) were the next most important determinants. Rural referral center status, medical-staff-to-beds ratio, the surgical specialist percentage, and the medical specialist percentage all had standardized coefficients between .05 and .07.

In the research developing PPS, Pettengill and Vertrees (1982) argued that a good measure of casemix should be proportional to costs at the hospital level, implying an elasticity close to 1.0 in a log-linear regression equation. The casemix elasticity in our regression was 1.05 and was significantly different than 1.00 at the 95 percent level of confidence. Pettengill and Vertrees obtained a casemix elasticity of 1.08, but their estimate was <u>not</u> significantly different than 1.00 in part because their regression had substantially higher <u>un</u>explained variation. Although not precisely 1.00, our casemix elasticity was approximately proportional to physician service volume and intensity suggesting that it could be used for policy formulations.

Building a casemix index from national weights implicitly assumes that the casemix measure and physician service volume and intensity were proportional across all types of medical staffs. We tested this by estimating a model allowing the relationship between casemix and RVUs to vary by hospital size. The model was the same as the basic model except that casemix is modelled as :

$$\text{LRVU} = b_0 + b_1\ \text{LCMI} + b_2\ (\text{LCMI*SIZE}) + \ldots..$$

where LRVU was logged RVUs per admission, LCMI was logged casemix, and SIZE was a dichotomous variable for large (100 beds or more) hospitals. Column 2 of Table V-3 indicates that the casemix differential was significant and indicates that casemix was more closely proportional to RVUs for small hospitals (b=1.01) than for large hospitals (b=1.01+.04). Recall

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a one standard deviation change in the independent variable. Thus, a one standard deviation change in casemix is associated with a .67 standard deviation change in RVUs per admission. These coefficients are not particularly useful for estimating changes in the absolute values of the dependent variable (i.e., RVUs per admission). Beta coefficients are useful, and are used in this instance, to assess the relative importance of the various independent variables in explaining variations in the dependent variable.

that we tested this assumption previously using charges and found the opposite to be true. Using charges we found that casemix was proportional for large hospitals (*b*=0.98) but not for small hospitals (*b*=0.98+.36=1.34). This was part of the motivation for a policy design option suggesting the alternative treatment of small hospitals.[34] In sum, we found the RVU casemix results encouraging. Although the overall casemix estimated with RVUs (*b*=1.05) was slightly less proportional than that estimated for charges (*b*=1.03), the RVU-based casemix appeared to be more representative of all medical staff types.

The third column of Table V-3 reports the results of the general model including GME RVUs. As discussed above, the teaching activity coefficient was negative and statistically significant (*b*=-.52). When GME RVUs were estimated and added to obtain total RVUs per admission, the teaching activity coefficient became positive and remained statistically significant (*b*=.47), as expected. Also as noted above, the disproportionate share coefficient fell dramatically and became insignificant, suggesting that the unexpected negative sign obtained for this variables was at least, in part, a function of the teaching activity in those hospitals. All other coefficients remained stable when GME RVUs were added to the dependent variable.

[34] Regardless of the casemix results, policymakers might want to consider exempting small hospitals from a medical staff policy or recognizing only part of the difference between the VPS standard and the performance of small hospitals. Small hospital are likely to have more volatile performances (i.e., RVUs per admission) due to small numbers of admissions.

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APPENDIX A

AVERAGING ADMISSIONS AND SIGNIFICANCE TESTING

For a number of research questions, one needs to test for significant differences in casemix-adjusted RVUs per admission. For instance, does a specific medical staff have intensity different from the state or national average? Did that medical staff's intensity change between two years? However, before significance tests can be specified, the average intensity for a medical staff must be specified.

Averaging Admissions

There are at least two ways to define the average intensity. For the first average, one calculates the average RVUs per admission for a medical staff and its average relative weight per admission. One then takes the ratio of the two averages:

$$(\Sigma R_i/n)/(\Sigma w_i/n) = \Sigma R_i/\Sigma w_i$$

where R_i is the RVUs of the ith admission, w_i is the relative weight of the ith admission, and n is the number of admissions in the hospital. We label this average the "PPS average," because some PPS payment parameters (e.g., teaching) are based on regressions of the average cost (analogous to RVUs) on the average weight and other variables.

The alternative average--labeled the non-PPS average--involves the ratio for each admission of RVUs and relative weights. This ratio is then summed over all admissions in the hospital:

$$\Sigma (R_i/w_i)/n$$

This ratio is the casemix-adjusted RVUs, averaged over a hospital's admissions.

Actually, the PPS average is an average of a hospital's admissions, only in this case each admission is weighted by the weight of its DRG:

$$[\Sigma (R_i/w_i)\, w_i]/\Sigma w_i = \Sigma R_i/\Sigma w_i$$

Note that if each admission has the same weight (w_i=c), this PPS average simplifies to the non-PPS average.

More concretely, the non-PPS average weights an admission for heart failure (DRG 127) and an admission for a coronary bypass with cardiac catheterization (DRG 106) the same, even though the second DRG has several times as many RVUs as the first DRG. The PPS average, implicitly using relative weights, recognizes these differences by DRG. Therefore, we believe the PPS average is conceptually superior.

Significance Testing

For significance testing, consider a variable x_i with a weight of w_i (as above). The mean estimator of x_i is calculated as

$$X = (\Sigma x_i w_i)/\Sigma w_i$$

The standard error is calculated as

$$S = [\phi \Sigma w_i (x_i - X)^2]^{1/2}$$

where $\phi = 1/((\Sigma w_i)(n-1))$. Then calculating the t-value is straightforward.

APPENDIX B:

Relative Weights for Physician Services by DRG

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated: 1989 RVU-Based Weights Stay Only	Truncated: 1989 RVU-Based Weights Stay/Windows	Untruncated: 1989 RVU-Based Weights Stay Only	Untruncated: 1989 RVU-Based Weights Stay/Windows
001	3.49	3.48	3.26	3.04	3.20	2.98
002	4.14	3.15	3.11	2.81	3.08	2.78
003	2.92	2.54	2.39	2.22	2.37	2.19
004	2.68	2.90	2.26	2.10	2.23	2.08
005	1.56	2.95	2.35	2.27	2.29	2.21
006	0.45	0.92	0.94	1.01	0.93	1.00
007	2.84	1.83	2.35	2.18	2.32	2.16
008	0.74	1.07	1.11	1.16	1.10	1.14
009	1.29	0.64	0.74	0.78	0.76	0.79
010	1.24	0.83	0.91	1.05	0.93	1.06
011	0.79	0.68	0.59	0.65	0.59	0.65
012	0.93	0.62	0.70	0.76	0.72	0.78
013	0.93	0.55	0.63	0.69	0.64	0.69
014	1.23	0.69	0.79	0.85	0.80	0.85
015	0.63	0.55	0.61	0.65	0.60	0.65
016	1.05	0.70	0.76	0.81	0.78	0.81
017	0.63	0.55	0.54	0.61	0.54	0.61
018	0.96	0.71	0.82	0.91	0.83	0.92
019	0.61	0.60	0.53	0.60	0.53	0.61
020	1.71	0.75	0.87	0.92	0.93	0.96
021	1.36	0.67	0.76	0.80	0.78	0.81
022	0.70	0.43	0.50	0.57	0.51	0.58
023	0.94	0.55	0.63	0.69	0.64	0.70
024	0.95	0.55	0.63	0.68	0.64	0.69
025	0.53	0.40	0.43	0.50	0.42	0.50
026	0.91	0.44	0.63	0.68	0.63	0.69
027	1.65	0.71	0.85	0.88	0.88	0.89
028	1.22	0.68	0.72	0.76	0.73	0.77
029	0.59	0.42	0.53	0.60	0.53	0.60

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated: 1989 RVU-Based Weights Stay Only	Truncated: 1989 RVU-Based Weights Stay/Windows	Untruncated: 1989 RVU-Based Weights Stay Only	Untruncated: 1989 RVU-Based Weights Stay/Windows
030	0.35	0.37	0.45	0.53	0.45	0.54
031	0.67	0.42	0.55	0.62	0.55	0.62
032	0.41	0.34	0.47	0.55	0.47	0.55
033	0.25	0.34	0.42	0.51	0.42	0.51
034	1.27	0.75	0.76	0.83	0.83	0.88
035	0.58	0.50	0.52	0.59	0.52	0.60
036	0.66	2.27	1.79	1.72	1.80	1.74
037	0.73	1.27	1.10	1.15	1.09	1.13
038	0.37	0.98	0.89	0.97	0.88	0.96
039	0.47	1.73	1.14	1.12	1.12	1.11
040	0.48	1.03	0.95	1.03	0.94	1.01
041	0.37	0.97	0.89	0.97	0.88	0.95
042	0.64	2.15	1.67	1.61	1.63	1.57
043	0.37	0.38	0.46	0.54	0.46	0.54
044	0.63	0.46	0.54	0.61	0.54	0.61
045	0.55	0.68	0.52	0.59	0.52	0.59
046	0.63	0.45	0.54	0.61	0.54	0.61
047	0.37	0.38	0.46	0.54	0.45	0.54
048	0.40	0.39	0.47	0.55	0.47	0.55
049	2.84	2.99	2.35	2.18	2.32	2.15
050	0.64	1.30	1.05	1.11	1.04	1.09
051	0.57	1.08	1.01	1.07	1.00	1.05
052	0.85	1.18	1.17	1.21	1.16	1.19
053	0.62	1.46	1.27	1.30	1.29	1.31
054	0.69	1.17	1.08	1.13	1.07	1.11
055	0.46	1.12	0.94	1.02	0.93	1.00
056	0.47	1.02	0.95	1.02	0.94	1.00
057	0.93	1.23	1.22	1.25	1.21	1.23
058	0.31	0.94	0.86	0.94	0.84	0.93
059	0.39	0.98	0.90	0.98	0.89	0.97
060	0.26	0.91	0.83	0.92	0.82	0.90
061	0.80	1.08	1.14	1.18	1.13	1.16
062	0.31	0.94	0.85	0.94	0.84	0.93
063	1.18	1.45	1.37	1.37	1.35	1.35

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated 1989 RVU-Based Weights Stay Only	Truncated 1989 RVU-Based Weights Stay/Windows	Untruncated 1989 RVU-Based Weights Stay Only	Untruncated 1989 RVU-Based Weights Stay/Windows
064	1.09	0.82	0.68	0.73	0.69	0.74
065	0.46	0.38	0.44	0.50	0.43	0.49
066	0.44	0.33	0.48	0.56	0.48	0.56
067	1.05	0.56	0.67	0.72	0.68	0.73
068	0.78	0.34	0.41	0.46	0.42	0.47
069	0.53	0.30	0.51	0.58	0.51	0.59
070	0.59	0.43	0.53	0.59	0.53	0.60
071	0.89	0.45	0.62	0.68	0.63	0.68
072	0.53	0.41	0.51	0.58	0.51	0.58
073	0.76	0.51	0.54	0.61	0.57	0.63
074	0.34	0.37	0.45	0.53	0.45	0.53
075	3.03	3.01	2.74	2.68	2.67	2.61
076	2.43	1.97	1.64	1.68	1.63	1.65
077	1.05	1.40	1.29	1.30	1.28	1.29
078	1.47	0.71	0.82	0.88	0.81	0.87
079	2.04	0.73	0.75	0.76	0.78	0.78
080	1.23	0.48	0.49	0.53	0.51	0.54
081	1.10	0.60	0.68	0.73	0.70	0.74
082	1.24	0.87	0.87	0.99	0.88	0.99
083	1.01	0.51	0.59	0.62	0.61	0.63
084	0.52	0.43	0.51	0.58	0.51	0.58
085	1.17	0.77	0.86	0.90	0.85	0.89
086	0.74	0.65	0.57	0.63	0.58	0.64
087	1.51	0.55	0.60	0.63	0.63	0.65
088	1.12	0.44	0.50	0.55	0.51	0.56
089	1.27	0.51	0.55	0.58	0.56	0.59
090	0.83	0.35	0.39	0.43	0.39	0.43
091	0.76	0.55	0.58	0.64	0.58	0.65
092	1.31	0.69	0.65	0.69	0.66	0.69
093	0.84	0.60	0.60	0.66	0.61	0.67
094	1.40	0.71	0.77	0.81	0.79	0.82
095	0.71	0.49	0.56	0.63	0.57	0.63
096	1.01	0.40	0.45	0.51	0.46	0.51
097	0.71	0.29	0.33	0.40	0.33	0.40

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated		Untruncated	
			1989 RVU-Based Weights			
			Stay Only	Stay/Windows	Stay Only	Stay/Windows
098	0.64	0.44	0.54	0.61	0.54	0.61
099	0.75	0.45	0.51	0.58	0.53	0.60
100	0.51	0.40	0.43	0.52	0.46	0.54
101	0.98	0.58	0.56	0.66	0.57	0.67
102	0.58	0.38	0.52	0.59	0.53	0.60
103	14.7	8.06	9.34	7.97	9.24	7.91
104	7.56	7.69	5.13	4.49	5.08	4.44
105	5.94	6.25	4.18	3.69	4.13	3.66
106	5.55	7.44	5.99	5.12	5.87	5.04
107	4.21	6.11	4.38	3.97	4.25	3.87
108	5.58	4.04	6.56	5.62	6.49	5.58
109	3.78	3.00	3.24	2.87	3.26	2.89
110	3.67	4.10	3.64	3.24	3.62	3.23
111	2.16	3.21	1.95	1.85	1.92	1.83
112	1.90	2.21	2.07	1.97	2.04	1.94
113	2.47	1.80	1.69	1.59	1.68	1.57
114	1.71	1.01	1.04	1.06	1.09	1.08
115	3.98	3.23	3.02	2.74	2.99	2.71
116	2.66	1.88	1.39	1.33	1.35	1.29
117	1.22	1.97	1.39	1.39	1.38	1.37
118	1.65	1.21	1.65	1.60	1.63	1.58
119	0.83	1.28	1.16	1.20	1.15	1.18
120	2.74	1.62	1.82	1.72	1.91	1.78
121	1.65	0.79	0.93	0.90	0.94	0.91
122	1.15	0.64	0.85	0.83	0.84	0.83
123	1.42	0.64	0.69	0.63	0.74	0.67
124	1.19	1.24	1.90	1.74	1.84	1.71
125	0.68	1.00	1.65	1.56	1.58	1.51
126	3.05	1.17	1.28	1.25	1.34	1.28
127	1.04	0.50	0.56	0.59	0.57	0.60
128	0.84	0.46	0.53	0.61	0.53	0.62
129	1.51	0.73	0.61	0.62	0.67	0.68
130	0.89	0.55	0.63	0.69	0.63	0.70
131	0.59	0.44	0.46	0.55	0.45	0.55

DRG Number	1989 PPS Weight	Truncated: 1987 Stay Only Charge-Based Weight	Truncated: 1989 RVU-Based Weights: Stay Only	Truncated: 1989 RVU-Based Weights: Stay/Windows	Untruncated: 1989 RVU-Based Weights: Stay Only	Untruncated: 1989 RVU-Based Weights: Stay/Windows
132	0.77	0.45	0.48	0.53	0.52	0.57
133	0.56	0.37	0.52	0.59	0.52	0.59
134	0.60	0.41	0.47	0.52	0.47	0.53
135	0.89	0.53	0.65	0.69	0.70	0.75
136	0.57	0.45	0.52	0.59	0.52	0.60
137	0.63	0.46	0.54	0.61	0.54	0.61
138	0.85	0.50	0.53	0.60	0.54	0.61
139	0.57	0.39	0.40	0.49	0.41	0.49
140	0.66	0.38	0.42	0.49	0.42	0.51
141	0.69	0.49	0.55	0.60	0.54	0.59
142	0.52	0.40	0.44	0.50	0.44	0.50
143	0.54	0.35	0.38	0.46	0.38	0.46
144	1.15	0.60	0.64	0.69	0.66	0.72
145	0.64	0.44	0.54	0.61	0.55	0.62
146	2.78	2.87	2.31	2.15	2.28	2.12
147	1.87	2.31	1.77	1.70	1.75	1.68
148	3.27	2.60	2.48	2.27	2.45	2.25
149	1.78	2.00	1.77	1.71	1.69	1.64
150	2.72	1.96	1.78	1.61	1.85	1.67
151	1.45	1.41	1.53	1.50	1.51	1.48
152	1.48	1.26	1.55	1.52	1.53	1.49
153	1.06	1.05	1.30	1.31	1.28	1.29
154	3.81	2.59	2.49	2.27	2.53	2.30
155	1.72	1.73	1.69	1.63	1.67	1.61
156	0.84	1.26	1.17	1.20	1.15	1.18
157	0.98	1.10	0.89	0.93	0.90	0.94
158	0.53	0.80	0.59	0.64	0.59	0.64
159	1.11	1.22	0.98	0.97	0.96	0.95
160	0.66	0.96	0.74	0.73	0.73	0.72
161	0.73	1.01	0.78	0.80	0.77	0.79
162	0.47	0.82	0.60	0.61	0.59	0.60
163	0.94	1.22	1.23	1.25	1.21	1.23
164	2.41	1.52	2.09	1.97	2.07	1.94
165	1.42	1.01	1.51	1.49	1.49	1.47

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated: 1989 RVU-Based Weights Stay Only	Truncated: 1989 RVU-Based Weights Stay/Windows	Untruncated: 1989 RVU-Based Weights Stay Only	Untruncated: 1989 RVU-Based Weights Stay/Windows
166	1.46	1.66	1.53	1.50	1.51	1.48
167	0.80	0.85	1.14	1.18	1.13	1.17
168	0.97	1.61	1.25	1.27	1.23	1.25
169	0.53	1.16	0.99	1.05	0.97	1.04
170	2.77	1.78	1.77	1.69	1.80	1.72
171	1.38	1.61	1.49	1.47	1.47	1.45
172	1.20	0.73	0.84	0.90	0.86	0.92
173	0.70	0.48	0.56	0.63	0.56	0.63
174	0.98	0.67	0.70	0.72	0.70	0.72
175	0.64	0.55	0.53	0.56	0.51	0.55
176	0.99	0.76	0.81	0.83	0.83	0.85
177	0.77	0.67	0.66	0.70	0.65	0.69
178	0.57	0.61	0.52	0.59	0.52	0.59
179	1.09	0.74	0.68	0.73	0.69	0.74
180	0.92	0.51	0.58	0.63	0.59	0.64
181	0.53	0.37	0.41	0.45	0.40	0.45
182	0.74	0.52	0.57	0.63	0.58	0.64
183	0.53	0.42	0.47	0.53	0.47	0.53
184	0.64	0.39	0.54	0.61	0.55	0.62
185	0.75	0.49	0.49	0.59	0.53	0.63
186	0.41	0.39	0.47	0.55	0.47	0.55
187	0.46	0.40	0.49	0.56	0.49	0.56
188	0.96	0.65	0.71	0.77	0.72	0.79
189	0.49	0.49	0.46	0.52	0.46	0.52
190	0.79	0.51	0.59	0.65	0.60	0.66
191	5.31	3.35	2.72	2.44	2.73	2.44
192	2.48	2.65	2.14	2.00	2.11	1.98
193	3.06	2.57	2.44	2.22	2.38	2.18
194	1.88	1.95	1.78	1.71	1.76	1.69
195	2.34	2.26	1.95	1.75	1.90	1.71
196	1.56	1.82	1.59	1.56	1.58	1.53
197	1.78	1.86	1.49	1.39	1.46	1.36
198	1.05	1.43	1.12	1.06	1.08	1.03
199	2.29	1.83	2.02	1.91	2.00	1.89

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated: 1989 RVU-Based Weights Stay Only	Truncated: 1989 RVU-Based Weights Stay/Windows	Untruncated: 1989 RVU-Based Weights Stay Only	Untruncated: 1989 RVU-Based Weights Stay/Windows
200	2.68	2.26	2.26	2.10	2.23	2.08
201	2.49	1.48	2.14	2.01	2.11	1.98
202	1.24	0.61	0.70	0.71	0.72	0.73
203	1.09	0.68	0.79	0.85	0.80	0.84
204	1.03	0.59	0.69	0.73	0.71	0.75
205	1.24	0.60	0.69	0.72	0.71	0.74
206	0.64	0.47	0.54	0.61	0.55	0.61
207	0.96	0.62	0.72	0.74	0.74	0.75
208	0.58	0.44	0.53	0.57	0.54	0.58
209	2.38	2.83	2.43	2.18	2.36	2.12
210	2.12	2.02	1.94	1.78	1.92	1.76
211	1.54	1.70	1.60	1.48	1.53	1.42
212	1.46	1.59	1.53	1.51	1.52	1.49
213	1.77	1.88	1.71	1.66	1.69	1.63
214	2.06	2.98	2.73	2.56	2.71	2.53
215	1.31	2.47	2.09	1.98	2.03	1.92
216	1.63	1.43	1.64	1.59	1.62	1.57
217	3.00	1.81	1.92	1.79	2.03	1.88
218	1.56	1.50	1.53	1.47	1.53	1.47
219	0.98	1.20	1.12	1.06	1.08	1.03
220	0.92	1.31	1.22	1.24	1.20	1.23
221	1.52	1.71	1.57	1.53	1.55	1.51
222	0.83	1.44	1.16	1.20	1.15	1.18
223	1.06	1.56	1.54	1.49	1.49	1.45
224	0.64	1.01	1.05	1.10	1.04	1.09
225	0.70	0.98	1.07	1.05	1.06	1.03
226	1.39	1.58	1.49	1.47	1.48	1.45
227	0.67	1.02	1.07	1.12	1.05	1.10
228	0.81	1.31	1.15	1.19	1.14	1.17
229	0.52	0.95	0.98	1.04	0.96	1.03
230	0.85	1.29	1.17	1.21	1.16	1.19
231	0.88	1.05	1.19	1.22	1.18	1.20
232	0.96	1.27	1.24	1.26	1.22	1.24
233	1.67	1.41	1.66	1.61	1.64	1.59

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated 1989 RVU-Based Weights: Stay Only	Truncated 1989 RVU-Based Weights: Stay/Windows	Untruncated 1989 RVU-Based Weights: Stay Only	Untruncated 1989 RVU-Based Weights: Stay/Windows
234	0.86	1.08	1.18	1.21	1.17	1.19
235	1.20	0.65	0.71	0.76	0.73	0.77
236	0.89	0.52	0.95	0.93	0.94	0.92
237	0.57	0.45	0.52	0.59	0.52	0.60
238	1.65	0.80	0.85	0.88	0.88	0.89
239	0.98	0.64	0.75	0.84	0.77	0.85
240	1.12	0.70	0.83	0.87	0.86	0.88
241	0.64	0.43	0.58	0.69	0.64	0.72
242	1.32	0.69	0.75	0.79	0.77	0.80
243	0.66	0.50	0.56	0.63	0.56	0.64
244	0.72	0.46	1.45	1.39	1.43	1.36
245	0.52	0.36	1.64	1.50	1.58	1.45
246	0.57	0.44	0.52	0.59	0.52	0.59
247	0.54	0.41	0.43	0.53	0.44	0.55
248	0.62	0.42	0.53	0.60	0.54	0.61
249	0.67	0.47	1.18	1.16	1.25	1.19
250	0.67	0.55	0.55	0.62	0.55	0.62
251	0.42	0.48	0.47	0.55	0.47	0.55
252	0.35	0.37	0.45	0.53	0.45	0.53
253	0.78	0.56	0.64	0.70	0.66	0.72
254	0.44	0.42	0.42	0.49	0.42	0.49
255	0.46	0.41	0.49	0.56	0.49	0.57
256	0.64	0.41	0.45	0.54	0.48	0.55
257	0.99	1.57	1.41	1.55	1.36	1.50
258	0.79	1.42	1.14	1.18	1.13	1.16
259	0.99	1.30	1.25	1.27	1.24	1.26
260	0.60	1.02	1.03	1.09	1.02	1.07
261	0.64	1.28	1.05	1.10	1.04	1.09
262	0.44	0.66	0.93	1.01	0.92	0.99
263	2.70	1.28	1.49	1.41	1.52	1.43
264	1.59	0.90	1.61	1.57	1.59	1.55
265	1.43	1.38	1.52	1.49	1.50	1.47
266	0.69	1.00	1.08	1.13	1.07	1.11
267	0.61	1.13	1.03	1.09	1.02	1.07

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated: 1989 RVU-Based Weights Stay Only	Truncated: 1989 RVU-Based Weights Stay/Windows	Untruncated: 1989 RVU-Based Weights Stay Only	Untruncated: 1989 RVU-Based Weights Stay/Windows
268	0.62	1.11	1.04	1.09	1.02	1.08
269	1.69	1.34	1.27	1.30	1.32	1.32
270	0.70	0.77	0.71	0.86	0.74	0.88
271	1.22	0.45	0.61	0.65	0.62	0.66
272	1.04	0.49	0.66	0.71	0.67	0.72
273	0.71	0.34	0.56	0.63	0.57	0.63
274	1.05	0.58	0.67	0.72	0.68	0.73
275	0.57	0.46	0.52	0.59	0.52	0.60
276	0.53	0.42	0.36	0.48	0.58	0.66
277	0.96	0.44	0.50	0.56	0.51	0.56
278	0.68	0.33	0.39	0.43	0.38	0.43
279	0.74	0.49	0.57	0.63	0.58	0.64
280	0.64	0.42	0.44	0.50	0.44	0.51
281	0.42	0.28	0.48	0.55	0.47	0.56
282	0.34	0.37	0.45	0.53	0.45	0.53
283	0.78	0.46	0.58	0.65	0.59	0.65
284	0.48	0.41	0.36	0.47	0.41	0.51
285	3.03	2.58	2.46	2.27	2.43	2.25
286	2.59	2.41	2.20	2.06	2.18	2.03
287	2.22	1.08	1.28	1.24	1.40	1.32
288	2.09	1.98	1.90	1.81	1.88	1.79
289	1.10	1.92	1.32	1.33	1.30	1.31
290	0.80	1.47	1.28	1.26	1.32	1.28
291	0.51	1.05	0.97	1.04	0.96	1.02
292	2.71	2.13	2.27	2.12	2.25	2.09
293	1.20	1.46	1.38	1.38	1.36	1.36
294	0.76	0.39	0.46	0.54	0.48	0.55
295	0.77	0.48	0.58	0.64	0.59	0.65
296	0.94	0.46	0.54	0.61	0.56	0.63
297	0.57	0.34	0.38	0.47	0.39	0.47
298	0.64	0.48	0.54	0.61	0.55	0.62
299	0.85	0.51	0.60	0.66	0.61	0.67
300	1.12	0.64	0.76	0.85	0.78	0.87
301	0.64	0.47	0.54	0.61	0.55	0.62

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated: 1989 RVU-Based Weights Stay Only	Truncated: 1989 RVU-Based Weights Stay/Windows	Untruncated: 1989 RVU-Based Weights Stay Only	Untruncated: 1989 RVU-Based Weights Stay/Windows
302	3.70	3.41	2.86	2.60	2.82	2.57
303	2.75	3.12	3.02	2.84	2.95	2.77
304	2.46	2.18	2.27	2.13	2.29	2.15
305	1.33	1.66	1.46	1.44	1.44	1.42
306	1.43	1.93	1.52	1.49	1.50	1.47
307	0.86	1.51	1.18	1.21	1.17	1.20
308	1.55	1.54	1.32	1.34	1.36	1.37
309	0.83	1.12	1.16	1.20	1.15	1.18
310	0.91	1.11	0.93	1.01	0.92	1.00
311	0.54	0.86	0.71	0.83	0.69	0.81
312	0.83	0.84	1.16	1.20	1.15	1.18
313	0.51	0.74	0.97	1.04	0.96	1.02
314	0.43	1.01	0.93	1.00	0.92	0.99
315	2.41	2.01	1.72	1.70	1.76	1.72
316	1.28	0.64	0.74	0.79	0.78	0.82
317	0.35	0.37	0.08	0.11	0.12	0.16
318	1.07	0.62	0.74	0.83	0.75	0.85
319	0.58	0.44	0.52	0.59	0.52	0.60
320	1.04	0.46	0.53	0.59	0.54	0.59
321	0.72	0.34	0.39	0.45	0.39	0.45
322	0.75	0.47	0.58	0.64	0.58	0.64
323	0.79	0.88	0.69	0.77	0.69	0.76
324	0.40	0.39	0.40	0.51	0.40	0.52
325	0.68	0.44	0.48	0.58	0.49	0.59
326	0.44	0.34	0.48	0.56	0.48	0.56
327	0.55	0.43	0.51	0.59	0.52	0.59
328	0.62	0.45	0.54	0.60	0.54	0.61
329	0.42	0.40	0.48	0.55	0.47	0.55
330	0.28	0.35	0.43	0.51	0.43	0.52
331	0.91	0.57	0.70	0.78	0.71	0.79
332	0.56	0.46	0.52	0.59	0.52	0.59
333	0.66	0.47	0.55	0.62	0.55	0.62
334	1.85	2.40	1.76	1.70	1.74	1.67
335	1.36	2.07	1.48	1.46	1.46	1.44

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated 1989 RVU-Based Weights Stay Only	Truncated 1989 RVU-Based Weights Stay/Windows	Untruncated 1989 RVU-Based Weights Stay Only	Untruncated 1989 RVU-Based Weights Stay/Windows
336	1.02	1.64	1.20	1.23	1.17	1.20
337	0.70	1.41	1.00	1.04	0.98	1.02
338	0.75	1.00	0.84	0.98	0.84	0.98
339	0.59	0.77	0.72	0.75	0.76	0.79
340	0.43	1.01	0.93	1.00	0.92	0.99
341	0.98	1.55	1.19	1.21	1.15	1.17
342	0.45	1.02	0.94	1.01	0.93	0.99
343	0.38	0.98	0.90	0.98	0.88	0.96
344	1.08	1.72	1.31	1.32	1.29	1.30
345	0.79	1.25	1.14	1.18	1.12	1.16
346	0.92	0.58	0.66	0.78	0.68	0.79
347	0.48	0.42	0.49	0.57	0.49	0.57
348	0.67	0.53	0.55	0.62	0.56	0.62
349	0.39	0.38	0.46	0.54	0.46	0.54
350	0.68	0.33	0.55	0.62	0.56	0.62
351	0.33	0.37	0.45	0.53	0.44	0.53
352	0.54	0.41	0.51	0.58	0.51	0.59
353	2.27	2.16	2.01	1.90	1.99	1.88
354	1.50	1.92	1.56	1.52	1.54	1.50
355	0.95	1.56	1.23	1.25	1.22	1.24
356	0.76	1.06	1.01	0.98	0.98	0.95
357	2.21	2.17	1.98	1.87	1.95	1.85
358	1.25	1.68	1.41	1.40	1.39	1.38
359	0.85	1.41	1.36	1.27	1.30	1.22
360	0.74	0.85	1.11	1.16	1.10	1.14
361	0.72	1.14	1.10	1.14	1.08	1.13
362	0.37	1.00	0.89	0.97	0.88	0.96
363	0.68	0.72	1.08	1.13	1.06	1.11
364	0.44	0.56	0.93	1.01	0.92	0.99
365	1.94	1.63	1.82	1.74	1.80	1.72
366	1.12	0.60	0.69	0.74	0.70	0.75
367	0.51	0.43	0.50	0.58	0.50	0.58
368	0.87	0.52	0.61	0.67	0.62	0.68
369	0.51	0.42	0.50	0.57	0.50	0.58
		Truncated			Untruncated	

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	1989 RVU-Based Weights			
			Stay Only	Stay/Windows	Stay Only	Stay/Windows
370	0.95	1.38	1.23	1.25	1.22	1.24
371	0.71	1.19	1.09	1.14	1.08	1.12
372	0.44	0.42	0.48	0.56	0.48	0.56
373	0.31	0.36	0.44	0.52	0.44	0.52
374	0.55	1.09	1.00	1.06	0.99	1.05
375	0.68	1.16	1.07	1.13	1.06	1.11
376	0.39	0.37	0.46	0.54	0.46	0.55
377	0.66	1.35	1.06	1.11	1.05	1.10
378	0.79	0.50	0.59	0.65	0.60	0.66
379	0.30	0.35	0.44	0.52	0.43	0.52
380	0.25	0.36	0.42	0.51	0.42	0.51
381	0.39	0.97	0.90	0.98	0.89	0.96
382	0.12	0.31	0.38	0.47	0.38	0.47
383	0.44	0.39	0.48	0.56	0.48	0.56
384	0.32	0.37	0.44	0.52	0.44	0.53
385	1.22	0.63	0.72	0.76	0.74	0.77
386	3.65	1.35	1.46	1.40	1.53	1.44
387	1.83	0.81	0.91	0.92	0.93	0.94
388	1.16	0.61	0.70	0.75	0.71	0.76
389	1.79	0.69	0.89	0.91	0.92	0.93
390	1.11	0.55	0.69	0.73	0.70	0.74
391	0.22	0.34	0.41	0.50	0.41	0.50
392	3.70	2.91	2.85	2.60	2.82	2.57
393	1.52	1.68	1.57	1.54	1.55	1.51
394	1.46	1.50	1.53	1.51	1.52	1.49
395	0.74	0.44	0.52	0.60	0.54	0.60
396	0.45	0.37	0.48	0.56	0.48	0.56
397	1.04	0.47	0.60	0.68	0.61	0.69
398	1.25	0.55	0.58	0.70	0.61	0.70
399	0.69	0.47	0.56	0.62	0.56	0.63
400	2.75	2.46	2.29	2.14	2.27	2.11
401	2.17	1.89	1.95	1.85	1.93	1.83
402	0.90	1.28	1.20	1.23	1.19	1.21
403	1.58	0.77	0.88	0.95	0.91	0.97

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated 1989 RVU-Based Weights Stay Only	Truncated 1989 RVU-Based Weights Stay/Windows	Untruncated 1989 RVU-Based Weights Stay Only	Untruncated 1989 RVU-Based Weights Stay/Windows
404	0.80	0.57	0.59	0.70	0.62	0.72
405	1.04	0.58	0.66	0.71	0.68	0.72
406	2.78	2.16	2.31	2.15	2.29	2.13
407	1.45	1.64	1.53	1.50	1.51	1.48
408	0.93	1.10	1.04	1.24	1.09	1.32
409	1.05	0.74	0.89	1.06	1.10	1.23
410	0.48	0.26	0.29	0.42	0.30	0.44
411	0.47	0.42	0.49	0.57	0.49	0.57
412	0.43	0.39	0.48	0.55	0.48	0.56
413	1.24	0.66	0.82	0.86	0.83	0.86
414	0.79	0.51	0.59	0.65	0.59	0.65
415	3.60	1.89	1.99	1.88	2.13	2.00
416	1.59	0.59	0.68	0.71	0.70	0.72
417	1.04	0.55	0.66	0.71	0.67	0.72
418	1.02	0.39	0.47	0.59	0.52	0.62
419	0.97	0.50	0.57	0.68	0.62	0.70
420	0.68	0.36	0.55	0.62	0.56	0.62
421	0.65	0.34	0.41	0.47	0.43	0.49
422	0.78	0.46	0.58	0.65	0.59	0.65
423	1.61	0.62	0.81	0.86	0.90	0.91
424	2.29	1.85	2.02	1.91	2.00	1.89
425	0.62	0.44	0.51	0.61	0.52	0.63
426	0.63	0.48	0.54	0.61	0.54	0.61
427	0.60	0.46	0.53	0.60	0.53	0.60
428	0.74	0.49	0.57	0.63	0.58	0.64
429	0.89	0.59	0.66	0.71	0.67	0.71
430	0.91	0.64	0.71	0.80	0.74	0.81
431	0.70	0.48	0.56	0.63	0.57	0.63
432	0.70	0.48	0.56	0.63	0.56	0.63
433	0.41	0.39	0.18	0.28	0.20	0.31
434	0.81	0.44	0.47	0.53	0.50	0.56
435	0.57	0.28	0.31	0.40	0.32	0.42
436	1.02	0.56	0.66	0.71	0.67	0.72
437	1.28	0.66	0.47	0.52	0.49	0.55

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated 1989 RVU-Based Weights Stay Only	Truncated 1989 RVU-Based Weights Stay/Windows	Untruncated 1989 RVU-Based Weights Stay Only	Untruncated 1989 RVU-Based Weights Stay/Windows
438	0.00	0.00	0.35	0.44	0.34	0.44
439	1.72	1.82	1.68	1.63	1.66	1.61
440	2.50	1.38	1.43	1.39	1.51	1.43
441	0.70	1.19	1.09	1.14	1.07	1.12
442	1.92	1.95	1.70	1.73	1.77	1.77
443	1.19	1.44	1.16	1.18	1.18	1.18
444	0.78	0.51	0.59	0.65	0.59	0.65
445	0.52	0.42	0.51	0.58	0.51	0.58
446	0.48	0.41	0.49	0.57	0.49	0.57
447	0.47	0.41	0.49	0.57	0.49	0.57
448	0.35	0.37	0.45	0.53	0.45	0.53
449	0.81	0.43	0.46	0.57	0.49	0.60
450	0.48	0.30	0.32	0.48	0.32	0.50
451	0.48	0.44	0.49	0.57	0.49	0.57
452	0.95	0.47	0.59	0.75	0.62	0.77
453	0.51	0.29	0.34	0.50	0.37	0.53
454	0.90	0.54	0.62	0.68	0.63	0.69
455	0.44	0.41	0.48	0.56	0.48	0.56
456	1.58	0.86	0.83	0.86	0.85	0.87
457	2.68	1.02	1.17	1.15	1.21	1.17
458	4.03	3.02	3.05	2.76	3.02	2.73
459	2.03	1.85	1.87	1.78	1.85	1.76
460	1.02	0.58	0.66	0.71	0.67	0.72
461	0.73	1.05	0.95	1.06	1.01	1.09
462	1.81	0.62	0.63	0.62	0.65	0.64
463	0.77	0.44	0.51	0.58	0.51	0.59
464	0.48	0.41	0.49	0.57	0.49	0.57
465	0.34	0.36	0.45	0.53	0.45	0.53
466	0.56	0.43	0.62	0.76	0.67	0.82
467	0.45	0.41	0.48	0.56	0.48	0.56
468	3.30	1.95	2.30	2.12	2.36	2.17
469	0.00	0.00	0.00	0.00	0.00	0.00
470	0.00	0.00	0.00	0.00	0.00	0.00
471	4.15	5.23	3.12	2.82	3.08	2.79

DRG Number	1989 PPS Weight	1987 Stay Only Charge-Based Weight	Truncated		Untruncated	
			1989 RVU-Based Weights			
			Stay Only	Stay/Windows	Stay Only	Stay/Windows
472	12.2	7.33	7.88	6.76	7.80	6.70
473	2.93	1.07	1.25	1.24	1.32	1.27
474	12.4	3.80	4.08	3.52	4.11	3.54
475	3.14	1.14	1.29	1.20	1.33	1.23
476	2.22	2.12	1.98	1.88	1.96	1.85
477	1.38	1.62	1.16	1.17	1.18	1.17

Table III-1
Regressions of Average RVUs per Admission on PPS Relative Weights

Dependent Variable	Unnormalized				Normalized[a]					
	Inter-cept	PPS Weight	Surgical DRG	Inter-action[b]	Inter-cept	PPS Weight	Surgical DRG	Inter action	R^2	F
Stay Only, Untruncated	12.57	12.30** (3.86)	12.33** (4.67)	9.59* (4.00)	.28	.39	.27	.30	.76	282
Stay Only, Truncated[c]	12.33	10.93** (3.83)	11.67** (4.64)	10.10** (3.97)	.29	.36	.27	.33	.75	267
Total, Untruncated	19.92	12.47** (4.10)	15.37** (4.96)	9.54* (4.24)	.37	.33	.28	.25	.75	269
Total, Truncated[c]	19.13	11.46** (4.07)	15.31** (4.93)	9.75* (4.22)	.37	.31	.29	.27	.75	258

a. Normalization involes dividing the average RVUs per admission by its mean and dividing the PPS weight by its mean, such that the transformed variables both have means of 1.0 in the regression.

b. Interaction = PPS weight times Surgical DRG.

c. Truncated at 2.5 times the DRG mean.

* Significant at 95 percent confidence level.
** Significant at 99 percent confidence level.
T-value in parentheses.
N = 264 for each regression.

Table III-2
Average RVUs per Admission by DRG Type

RVUs per Admission	All DRGs	Surgical DRGs	Medical DRGs
Stay Only, Truncated[a]	35.82	70.31	22.14
Stay Only, Untruncated	37.68	73.18	23.54
Stay/Windows, Truncated[a]	43.68	80.49	29.08
Stay/Windows, Untruncated	45.66	83.20	30.76

N = 477 for All DRGs; 207 for Surgical DRGs; and 270 for Medical DRGs. All figures are admission weighted.

a. Truncated at 2.5 times the DRG mean.

Table III-3

Correlation between Sets of Relative Weights for Inpatient Physician Services

	Charges		1989 RVUs			
	Stay Only Truncated		Stay Only		Stay/Windows	
	1987	1989	Untruncated	Truncated	Untruncated	Truncated
Stay Only, Truncated 1987 Charge Weights	1.000					
Stay Only, Truncated 1989 Charge Weights	.982	1.000				
Stay Only, Untruncated 1989 RVU Weights	.956	.978	1.000			
Stay Only, Truncated 1989 RVU Weights	.958	.979	.999	1.000		
Stay/Windows, Untruncated 1989 RVU Weights	.956	.977	.998	.998	1.000	
Stay/Windows, Truncated 1989 RVU Weights	.958	.978	.998	.998	.999	1.000

Note: All correlations are significant at the 99 percent confidence.
N = 477.

Table III-4
Regressions of 1989 RVU-Based Weights

Dependent Variable	Independent Variable	Intercept	Coefficient	R^2	F
Stay, Untruncated	Stay, Truncated[a]	.019	.981** (.001)	.999	448,684
Stay/Windows, Truncated[a]	Stay, Truncated[a]	.140	.860** (.002)	.996	119,485

a. Truncated at 2.5 times the DRG mean.

** Significantly different from 1.0 at the 99 percent confidence level.
Standard error in parentheses.
N = 477 for each regression.

Table III-5
Regressions of RVU-Based Weights on Charge-Based Weights
(All variables are stay, truncated[a])

Dependent Variable	Independent Variable	Intercept	Coefficient	R^2	F
1989 RVU-Based Weight	1987 Charge-Based Weight	.183	.809** (.012)	.918	4892
1989 RVU-Based Weight	1989 Charge-Based Weight	.151	.860** (.009)	.958	9908

a. Truncated at 2.5 times the DRG mean.

** Significantly different than 1.0 at the 99 percent confidence level.
Standard Error in parentheses.
N = 477 for each regression.

Table IV-I

Mean RVUs as a
Ratio of U.S. Mean RVUs by Medical Staff Type
(Inpatient Stay, Truncated for Outliers)

Hospital Type	Casemix Index	Unadjusted	Casemix Adjusted	Adjusted With GME	Casemix Number of Hospitals	Number of Admissions in Sample
UNITED STATES	1.00	1.00	1.00	1.00	5076	432,772
CONTROL						
Private Nonprofit	1.04	1.04	1.02	1.02	2981	320,486
Government	.92	0.80	0.87	0.89	1380	63,843
For-Profit	0.99	1.03	1.06	1.01	715	48,443
BED SIZE						
<50	0.69	0.44	0.65	0.61	1214	19,015
50-100	0.79	0.64	0.82	0.77	1193	44,757
101-200	0.91	0.87	0.98	0.93	1150	88,474
201-300	1.02	1.04	1.06	1.02	681	94,199
301-500	1.10	1.13	1.06	1.08	615	120,293
>500	1.26	1.28	1.05	1.17	223	66,034
URBAN/RURAL						
Rural	0.82	0.68	0.83	0.78	2399	99,000
Other Urban	1.08	1.09	1.03	1.02	1447	178,125
Large Urban	1.06	1.10	1.07	1.12	1230	155,647
TEACHING						
Non-Teaching	0.92	0.88	0.97	0.90	3958	245,379
IRB<.25	1.11	1.15	1.06	1.08	911	149,799
IRB>.25	1.25	1.16	0.95	1.29	207	37,594
DISPROPORTIONATE SHARE						
No	0.99	0.97	0.99	0.96	3735	276,655
Yes	1.06	1.05	1.01	1.07	1341	156,117
REGION						
New England	1.01	0.99	1.00	1.04	206	21,700
Mid Atlantic	1.00	1.01	1.05	1.11	519	69,930
South Atlantic	1.02	1.02	1.01	1.00	770	80,407
East North Central	1.01	0.97	0.98	1.00	787	75,902
East South Central	0.94	0.91	0.97	0.94	451	37,420
West North Central	1.04	0.94	0.89	0.89	703	33,746
East North Central	1.01	1.05	1.05	1.01	706	48,427
Mountain	1.07	1.08	1.01	0.97	321	18,193
Pacific	1.08	1.03	0.98	0.95	572	44,104

The mean number of RVUs per admission unadjusted is 37.21; and casemix adjusted with GME is 38.69.

Table V-I
Means and Standard Deviations of Regression Variables

Variable	Mean	Standard Deviation	Data Source
Physician RVUs per Admission	37.21	12.44	1989 HCFA MedPAR and BMAD files
Physician + GME RVUs per Admission	40.22	15.21	1989 HCFA MedPAR, BMAD, and GME files
Casemix-Adjusted Physician RVUs per Admission	36.08	7.07	1989 HCFA MedPAR and BMAD files
Casemix-Adjusted Physician + GME RVUs per Admission	38.69	8.80	1989 HCFA MedPAR, BMAD and GME files
Casemix	1.02	0.24	1989 HCFA MedPAR and BMAD files
Bed Size	309	215	1989 HCFA HCRIS and Provider Specific files
IRB Ratio	.07	.14	1989 HCFA HCRIS and Provider Specific files
Disproportionate Share	.36	.48	1989 HCFA HCRIS and Provider Specific files
Other Urban[a]	41.16%	49.21	1989 HCFA HCRIS and Provider Specific files
Large Urban[a]	35.97%	47.99	1989 HCFA HCRIS and Provider Specific files
Rural Referral Center[a]	5.61%	23.02	1989 HCFA HCRIS and Provider Specific files
Sole Community[a]	2.62%	15.96	1989 HCFA HCRIS and Provider Specific files
Proprietary[a]	11.19%	31.53	1989 HCFA HCRIS and Provider Specific files
Nonfederal Government[a]	14.73%	35.44	1989 HCFA HCRIS and Provider Specific files
Federal Government[a]	0.00%	1.50	1989 HCFA HCRIS and Provider Specific files
Medical Staff/Bed	.71	1.09	1990 AHA Annual Survey and 1989 HCFA Provider Specific files
Surgeons/Medical Staff	25.02%	8.05	1990 AHA Annual Survey file
Specialists/Medical Staff	36.49%	12.56	1990 AHA Annual Survey file
RAPs/Medical Staff	11.33%	5.56	1990 AHA Annual Survey file
East North Central[a]	17.54%	38.03	Census Bureau Definition
East South Central[a]	8.65%	28.11	Census Bureau Definition
West North Central[a]	7.80%	26.81	Census Bureau Definition
West South Central[a]	11.19%	31.52	Census Bureau Definition
South Atlantic[a]	18.58%	38.89	Census Bureau Definition
Mid Atlantic[a]	16.16%	36.81	Census Bureau Definition
Mountain[a]	4.20%	20.07	Census Bureau Definition
Pacific[a]	10.19%	30.25	Census Bureau Definition

a. Dichotomous variable, percentage coded 1 is reported.

Table V-2
Regression Results-Policy Model
Casemix-Adjusted RVUs per Admission, Stay Only, Truncated
Parameter Estimates and t-Values

Variable	Basic Model Model 1	Regional Model Model 2	Regional Model w/GME Model 3
Intercept	2.86** (148.31)	2.86** (136.03)	2.87** (139.95)
Bed Size	0.11** (27.15)	0.11** (26.54)	0.11** (27.10)
I/R Ratio	-0.52** (-20.92)	-0.49** (-19.89)	0.46** (18.80)
Disproportionate Share	-0.21** (-5.81)	-0.25** (-6.79)	-0.05 (-1.43)
Large Urban	0.23** (26.55)	0.23** (25.63)	0.23** (26.30)
Other Urban	0.18** (21.15)	0.17** (21.11)	0.17** (21.05)
Rural Referral Center	0.12** (9.74)	0.12** (9.88)	0.12** (10.12)
Sole Community	-0.02 (-1.09)	-0.01 (-0.95)	-0.01 (-0.71)
East North Central	n.a.	-0.01 (-1.27)	-0.02 (-1.62)
East South Central	n.a.	0.01 (0.74)	0.01 (0.47)
South Atlantic	n.a.	0.01 (1.23)	0.01 (1.12)
Mid Atlantic	n.a.	0.03** (2.84)	0.04** (3.63)
West North Central	n.a.	-0.06** (-4.51)	-0.06** (-4.92)
West South Central	n.a.	0.07** (6.06)	0.06** (5.49)
Mountain	n.a.	0.04** (2.82)	0.03* (2.12)
Pacific	n.a.	-0.02 (-1.56)	-0.03** (-2.58)
Adjusted R^2	.40	.42	.56

N = 5076 for each regression.
** Significant at 99 percent confidence level.
* Significant at 95 percent confidence level.
t-Value in parentheses.

Table V-3
Regression Results-General Model
RVUs per Admission, Stay Only, Truncated
Parameter Estimates and t-Values

Variable	Basic Model Model 1	Basic Model w/ Casemix Differential Model 2	Basic Model w/GME Model 3
Intercept	2.96** (107.85)	2.98** (106.61)	2.87** (106.56)
Casemix	1.05** (72.87)	1.01** (56.54)	0.98** (69.40)
Casemix Differential	n.a.	0.04** (3.79)	n.a.
Bed Size	0.08** (16.47)	0.07** (12.70)	0.09** (18.95)
I/R Ratio	-0.52** (-19.94)	-0.51** (-19.34)	0.47** (18.39)
Disproportionate Share	-0.13** (-3.64)	-0.14** (-3.97)	0.02 (0.58)
Large Urban	0.14** (15.14)	0.14** (14.86)	0.15** (16.55)
Other Urban	0.10** (11.86)	0.10** (11.52)	0.11** (13.11)
Rural Referral Center	0.08** (6.87)	0.07** (6.23)	0.08** (7.57)
Sole Community	0.00 (-0.30)	0.00 (-0.17)	0.00 (-0.22)
Federal	0.01 (0.05)	0.00 (0.02)	0.00 (-0.02)
Proprietary	0.04** (5.23)	0.04** (5.03)	0.05** (6.43)
State Government	-0.04** (-6.18)	-0.04** (-6.14)	-0.04** (-5.52)
Staff/Bed Ratio	0.04** (8.18)	0.04** (8.09)	0.03** (6.16)

Table V-3
Regression Results-General Model
RVUs per Admission, Stay Only, Truncated
Parameter Estimates and t-Values
(con't)

Variable	Basic Model Model 1	Basic Model w/ Casemix Differential Model 2	Basic Model w/GME Model 3
Surgeons/Staff	0.27** (8.43)	0.26** (8.21)	0.28** (8.96)
Specialists/Staff	0.17** (6.95)	0.16** (6.74)	0.19** (7.78)
RAPs/Staff	0.07# (1.75)	0.07 (1.60)	0.06 (1.42)
East North Central	0.01 (0.89)	0.01 (0.94)	0.01 (0.55)
East South Central	0.03** (2.84)	0.04** (2.94)	0.03* (2.14)
South Atlantic	0.01 (1.18)	0.01 (1.23)	0.01 (1.15)
Mid Atlantic	0.04** (3.81)	0.04** (3.83)	0.05** (4.47)
West North Central	-0.04** (-2.95)	-0.04** (-2.90)	-0.03** (-2.80)
West South Central	0.08** (7.19)	0.08** (7.29)	0.08** (6.78)
Mountain	0.02 (1.57)	0.02 (1.58)	0.02# (1.70)
Pacific	-0.03** (-2.80)	-0.03** (-2.72)	-0.03** (-2.72)
Adjusted R^2	.83	.83	.86

N = 5075 for each regression.
** Significant at 99 percent confidence level.
* Significant at 95 percent confidence level.
# Significant at 90 percent confidence level.
t-Value in parentheses.